Cumulative AP Practice Test 2 Solutions

Page 470

AP2.1 a.
AP2.2 d.
AP2.3 e.
AP2.4 b.
AP2.5 c.
AP2.6 e.
AP2.7 c.
AP2.8 a.
AP2.9 d.
AP2.10 c.
AP2.11 b.
AP2.12 c.
AP2.13 d.
AP2.14 c.
AP2.15 d.
AP2.16 c.
AP2.17 e.
AP2.18 a.
AP2.19 c.
AP2.20 b.
AP2.21 a.

AP2.22 (a) This is an observational study. No treatments were imposed on the subjects.
(b) Two variables are confounded when their effects on the cholesterol level cannot be distinguished from one another. For example, people who take omega-3 fish oil might also be more health conscious in general and do other things such as eat more healthfully or exercise more. Researchers would not know whether it was the omega-3 fish oil or the more healthy food consumption or exercise that was the real explanation of lower cholesterol.
(c) No. Even though the difference was statistically significant, we cannot conclude that fish oil was the cause of the difference in mean cholesterol readings. This wasn't an experiment and taking fish oil is possibly confounded with other good habits, such as healthful eating and exercise.

AP2.23 (a) P(type O or Hawaiian-Chinese) = 65,516/145,057 = 0.452. There is a 0.452 probability that a specimen contains type O blood or comes from the Hawaiian-Chinese ethnic group.
(b) P(type AB | Hawaiian) = 99/4670 = 0.021. Given that a specimen comes from the Hawaiian ethnic group, there is a 0.021 probability that it is type AB.
(c) P(Hawaiian) = 4670/145,057 = 0.032; P(Hawaiian | type B) = 178/17,604 = 0.010. Because these probabilities are not equal, the two events are not independent. Knowing that a specimen is type B makes it less likely to have come from the Hawaiian ethnic group.
(d) The probability of randomly selecting a specimen that contains type A blood from the white ethnic group is 50,008/145,057 = 0.345. The probability that at least one of the two samples matches this description = 1 – P(neither are type A from white ethnic group) = $1 - (1 - 0.345)^2$ =

0.571. There is a 0.571 probability that at least one of the two specimens contains type A blood from the White ethnic group.

AP2.24 (a) The distribution of seed mass for the cicada plants is roughly symmetric while the distribution of seed mass for the control plants is skewed to the left. The median seed mass is the same for both groups. The cicada plants had a bigger range in seed mass, but the control plants had a bigger *IQR*. Neither group had any outliers.
(b) The distribution of seed mass for the cicada plants has the higher mean. The distribution of seed mass for the cicada plants is roughly symmetric, which suggests that the mean should be about the same as the median. However, the distribution of seed mass for the control plants is skewed to the left, which will pull the mean of this distribution below its median toward the lower values. Because the medians of both distributions are equal, the mean for the cicada plants is greater than the mean for the control plants.
(c) The purpose of the random assignment is to create two groups of plants that are roughly equivalent at the beginning of the experiment. The random assignment should balance out the effects of other variables (e.g., soil quality, light exposure) among the two treatments.
(d) Controlling a source of variability is a benefit of using only American bellflowers. Different types of flowers will have different seed masses, making the response more variable if other types of plants were used. However, using only American bellflowers means that we can't make inferences about the effect of cicadas on other types of plants, because other plants might respond differently to cicadas.

AP2.25 (a) **Step 1: State the distribution and values of interest.** If the total number of pages is fewer than 25,000, the average length of these novels is fewer than $\bar{x}$ = 25,000/50 = 500 pages. Because the sample size is large (n = 50 ≥ 30), the distribution of $\bar{x}$ is approximately Normal with $\mu_{\bar{x}} = \mu = 525$ pages. Because n = 50 is less than 10% of all novels in the library, $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{200}{\sqrt{50}} = 28.28$ pages. We want to find $P(\bar{x} < 500)$ using the $N(525, 28.28)$ distribution. **Step 2: Perform calculations. Show your work.** The standardized score for the boundary value is $z = \frac{500-525}{28.28} = -0.88$. The desired probability is $P(Z < -0.88) = 0.1894$. *Using technology*: normalcdf(lower: –1000, upper: 500, μ : 525, σ : 28.28) = 0.1883. **Step 3: Answer the question.** There is a 0.1883 probability that the total number of pages in 50 novels is fewer than 25,000.
(b) Let X be the number of novels that have fewer than 400 pages. X is a binomial random variable with n = 50 and p = 0.30. We want to find $P(X \geq 20)$. *Using technology*: $P(X \geq 20) = 1 - P(X \leq 19)$ = 1 – binomcdf(trials: 50, p : 0.30, x value: 19) = 1 – 0.9152 = 0.0848. There is a 0.0848 probability of selecting at least 20 novels that have fewer than 400 pages.
We can also use a normal approximation for the distribution of $\hat{p}$. S**tep 1: State the distribution and values of interest.** If the total number of novels with fewer than 400 pages is at least 20, the proportion of novels with fewer than 400 pages is at least $\hat{p}$ = 20/50 = 0.40. Because $np = 50(0.30) = 15 \geq 10$ and $n(1-p) = 50(0.70) = 35 \geq 10$, the distribution of $\hat{p}$ is approximately Normal with $\mu_{\hat{p}} = p = 0.30$. Because n = 50 is less than 10% of all novels in the library, $\sigma_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}} = \sqrt{\frac{0.30(0.70)}{50}} = 0.0648$. We want to find $P(\hat{p} \geq 0.40)$ using the $N(0.30, 0.0648)$ distribution. **Step 2: Perform calculations. Show your work.** The

standardized score for the boundary value is $z = \frac{0.40 - 0.30}{0.0648} = 1.54$. The desired probability is $P(Z \geq 1.54) = 1 - 0.9382 = 0.0618$. *Using technology*: normalcdf(lower: 0.40, upper: 1000, μ: 0.30, σ: 0.0648) = 0.0614. **Step 3: Answer the question.** There is a 0.0614 probability that the total number of novels with fewer than 400 pages is at least 20.